EXHIBIT B

Presentation by Dr. James C. Stevens of The Dow Chemical Company

The Use of High Throughput Experimentation In Catalyst Research

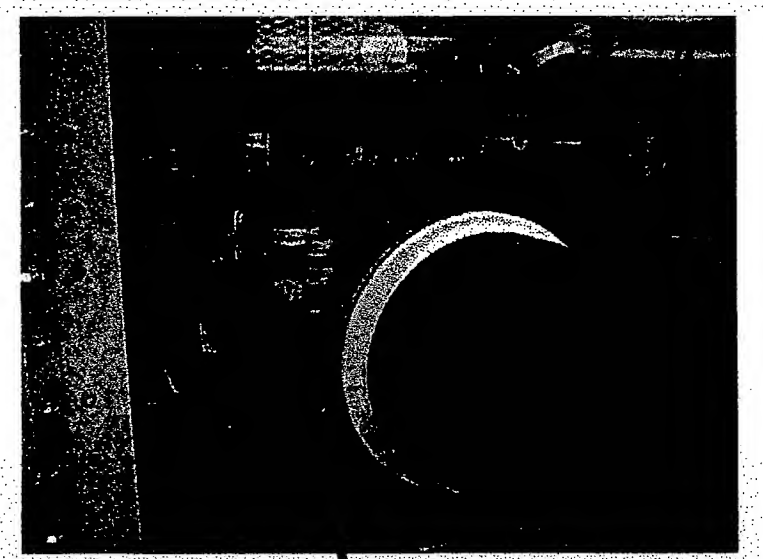
J. C. Stevens, R. Rosen

The Dow Chemical Company
Freeport, TX

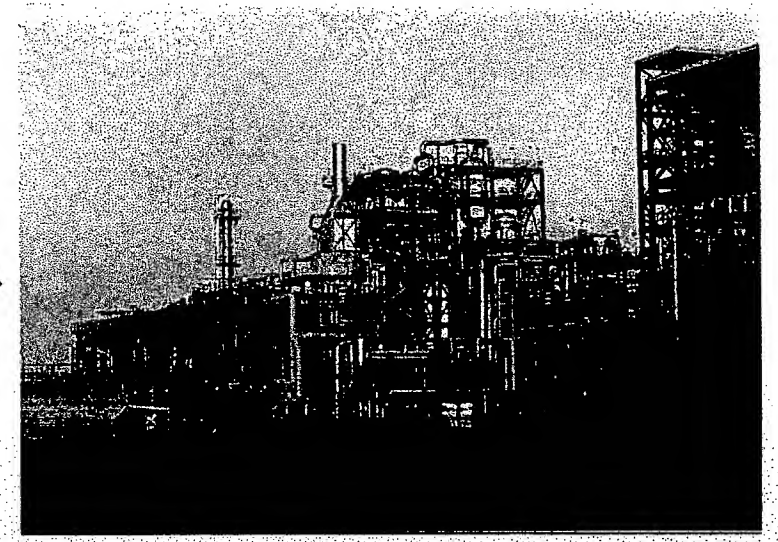
T. Boussie, G. Diamond, C. Goh, K. Hall, A. M. LaPointe, M. Leclerc, C. Lund, V. Murphy, J. Shoemaker, H. Turner, U. Tracht, T. Uno

Symyx Technologies
Santa Clara, CA

New Polyolefin Catalysts Drive New Business Growth



From this



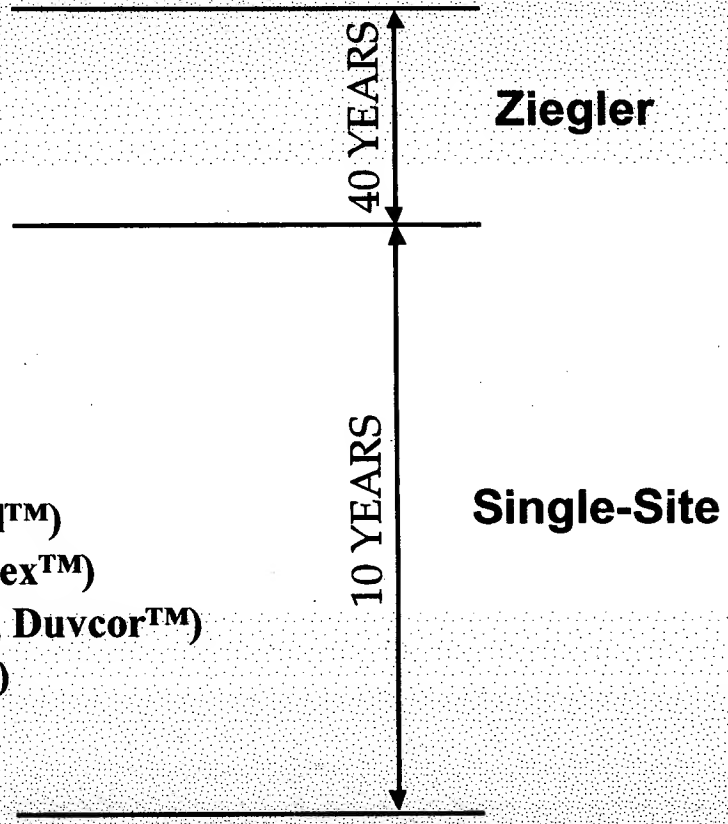
To this

The Rate of New Product Creation Has Been Faster With Single-Site Catalysts

- HDPE
- (L)LDPE
- PP
- EPDM

Plastomers (AFFINITY™, Exact™, Luflexen™)
Ethylene/norbornene elastomers (NORDEL-IP™)
Ethylene/octene elastomers (ENGAGE™)
Ethylene/styrene interpolymers (INDEX™)
Elastomeric/soft PP homopolymers (EHPP, FPO)
Liquid polyolefins (Trilene™, Paramins™, Versipol™)
Ethylene/CO copols. (polyketones Carilon™, Ketonex™)
Poly(substituted)norbornene (Avatrel™, Appear™, Duvcor™)

- Ethylene/cyclic olefin copolymers (Topas™, Apel™)
- Syndiotactic polystyrene (QUESTRA™, Xarec™)



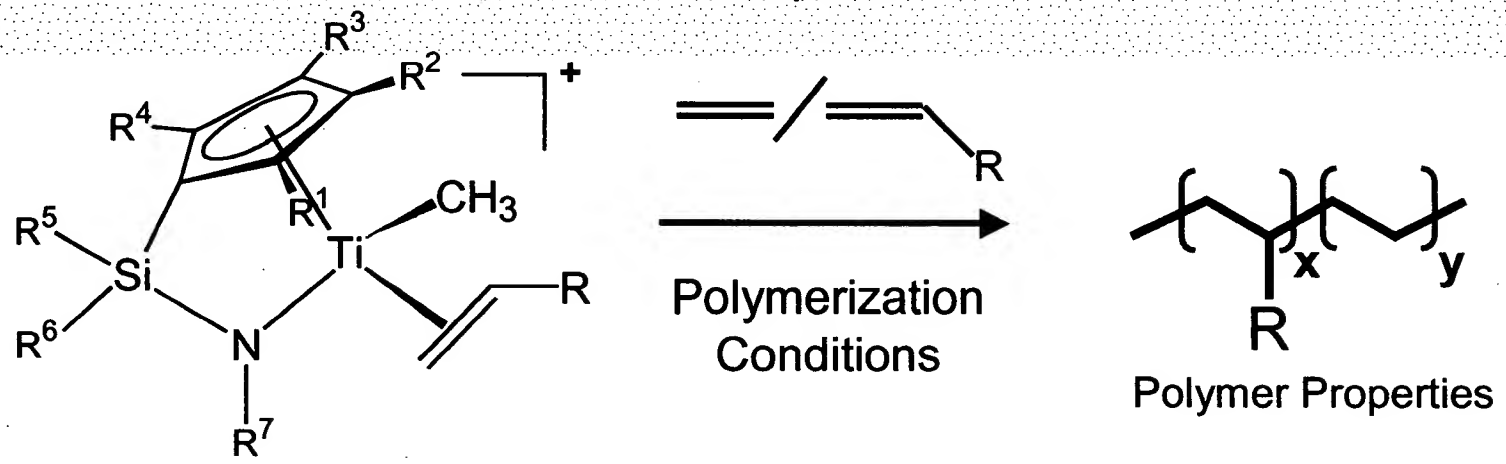
Rate of New Market Creation. Source: STA* research

Single-Site Catalyst Discovery Research Centers On :

- More Productive Catalysts
- Higher Temperature Operation
- Higher Molecular Weights
- Higher Comonomer Contents
- Improved / Novel Control of Sequence Distributions
- Incorporation of New Comonomers
- Improved / Differentiated Products
- Novel Polymer Microstructures and Tacticity

Complete Evaluation of the Structure / Activity Relationships for any Catalyst Family is a Daunting Task

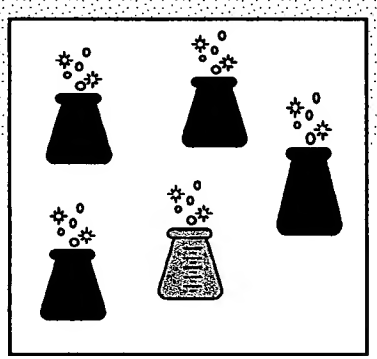
The Energy Surface for a Copolymerization is Highly Complex



1) Properties of active site and polymer can be affected *dramatically and unpredictably* by variations in choice of Metal, Ligand(s), Activation Method and Process Conditions

2) Choosing Ten Substituents for Each Position on this ligand Generates around 10,000,000 Compounds !!!

The Conventional Way of Doing Catalyst R&D is Effective But Can Be Slow



Catalyst synthesis and purification

Prepare solution in drybox

Catalyst

Combine with activator package

Activated catalyst

Perform polymerization

Polymer sample

Submit samples for analysis, wait 4-6 weeks, evaluate results

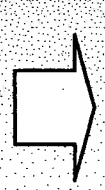
Design a new catalyst

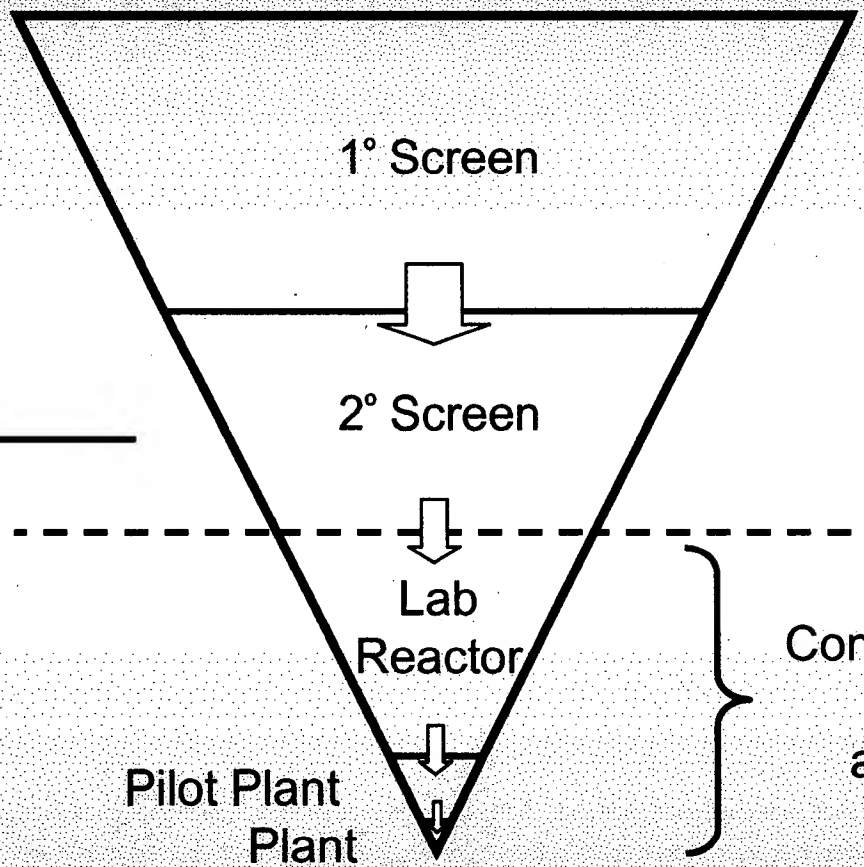
Ideas

Development time from idea to commercial catalyst is 5-10 years or more!

Combinatorial and High-Throughput Approaches to Catalyst Discovery

Ideas





info

High Throughput Approach - Collaboration with Symyx Technologies

Conventional R&D at Dow

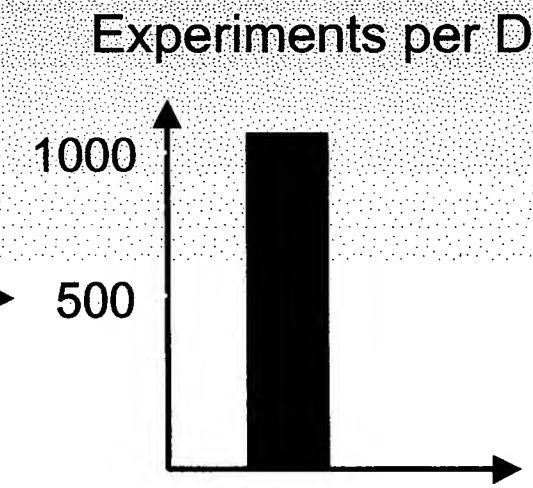
DOW

Symyx®

Experimental Throughput of Symyx / Dow Collaboration

"Discovery Screening"
High Throughput
Lower Precision
Yes/No Approach

Primary Screening

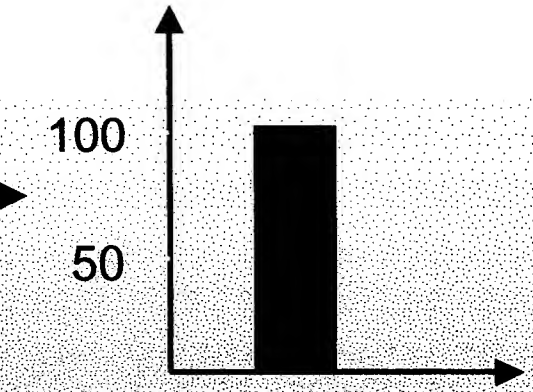


Hits and Information

"Optimization Screening"

Moderate Throughput
Higher Precision

Secondary Screening



"Experiment" means catalyst synthesis, polymerization, and analysis of performance, polymer properties, etc.

High Throughput Catalyst Discovery Requires:

Large Number of Ligands with Suitable Diversity

Efficient Methods of Attaching Ligands to Metals

Comprehensive Activation Strategies

High Throughput ***Primary*** Screen

- Rapid analytical for activity, molecular weight, at smaller scales

High Throughput ***Secondary*** Screen

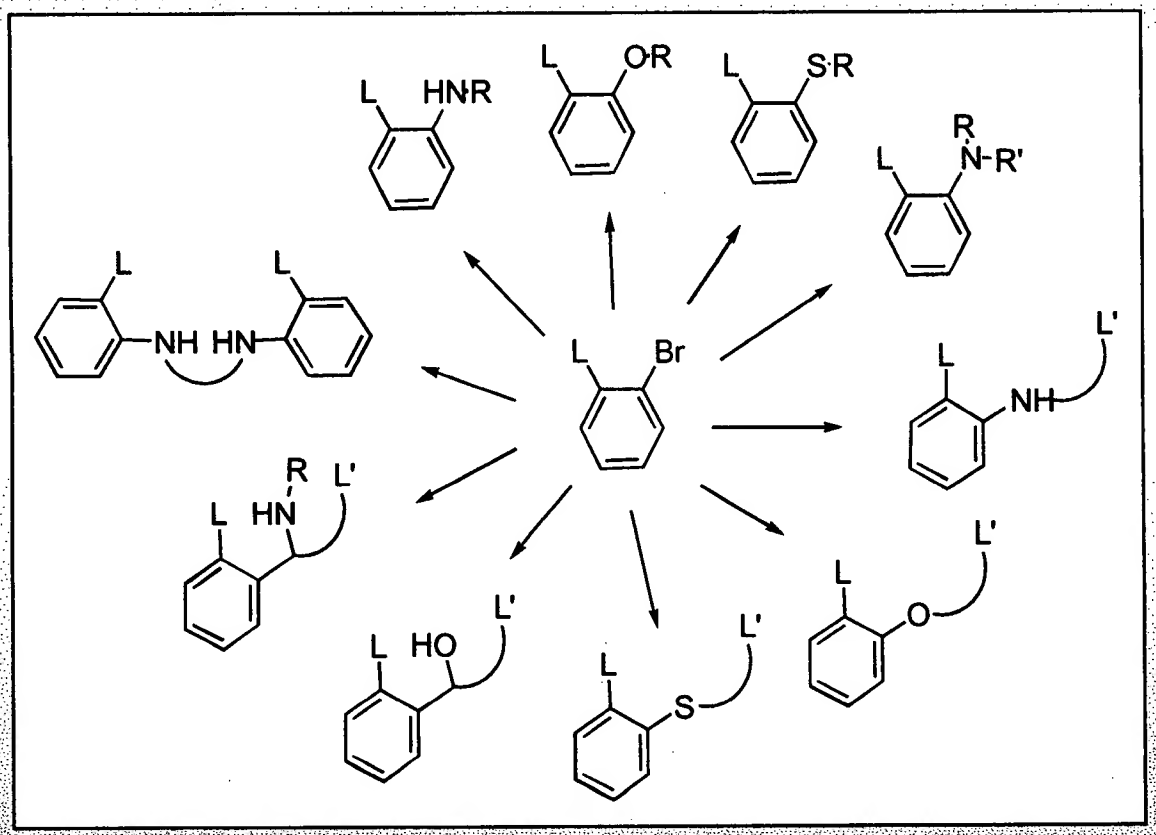
- Rapid analytical for activity, molecular weight, MWD, comonomer incorporation, tacticity, etc

Ligand Diversity: The Building Block Strategy

How can we exploit parallel synthesis techniques to create *diverse* ligand libraries?

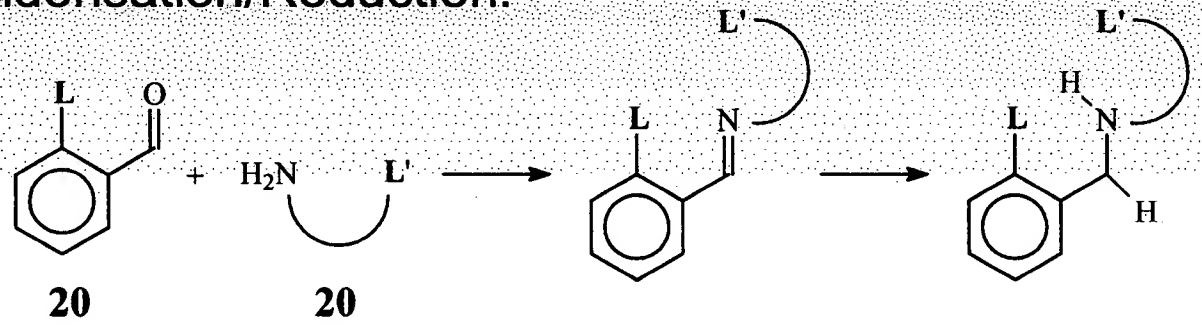
- Focus on post-metallocene catalyst systems
- Create diverse functionalized building blocks
- Connect building blocks using high-yield coupling reactions

The Parallel Building-Block Approach Leads To Significant Diversity:



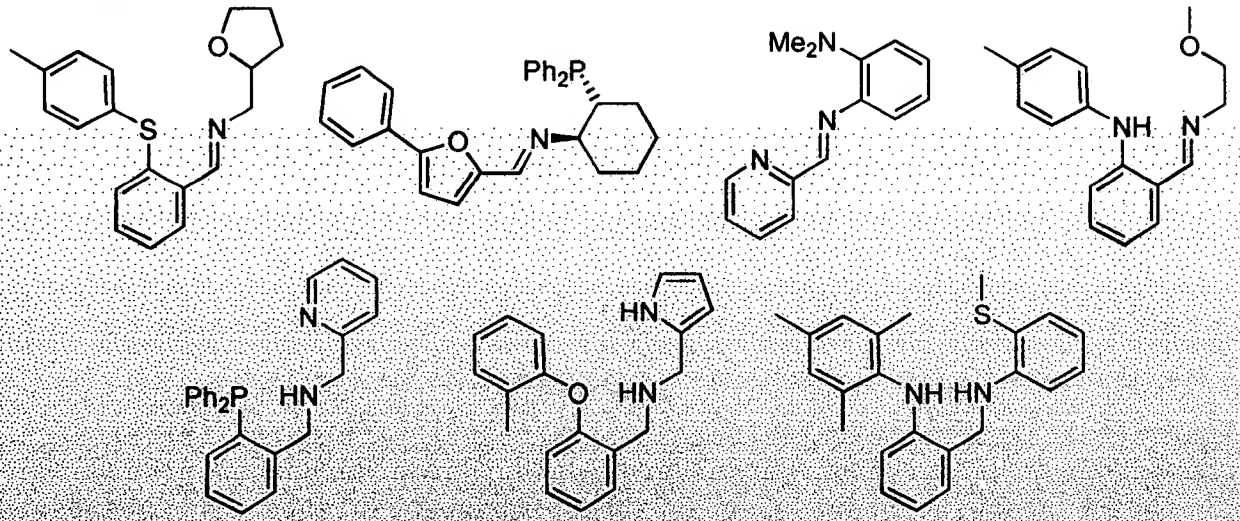
One Example of Ligand Diversity via General Transformations

imine Condensation/Reduction:



20 20

20 x 20 x 2 = *800* Examples !!



800 ligands x 6 metals x 3 monomers x 5 activators x 3 temperatures = 216,000 experiments!

Issues With Parallel Synthesis of Activated Metal Complexes

How can I rapidly ...

- Synthesize a diverse set of organometallic compounds, and
- know what I made, and
- select the appropriate activator?

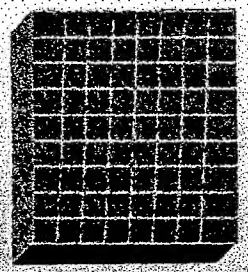
By ...

- accommodating multiple organometallic routes, and
- multiple activation chemistries for each metal / ligand set, and
- validating chemistry with models before experiment and for all hits

Ligands

Substructure

Substituents

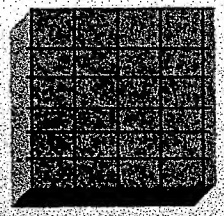


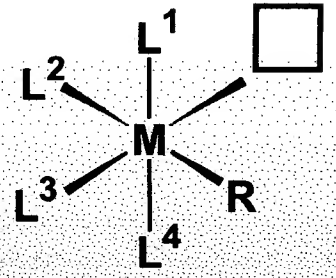
+

Metal Precursors

$Ti[NMe_2]_4$
$Zr[NMe_2]_4$
$Hf[NMe_2]_4$
$Ti[CH_2Ph]_4$
$Zr[CH_2Ph]_4$
$Hf[CH_2Ph]_4$

Activators/Modifiers



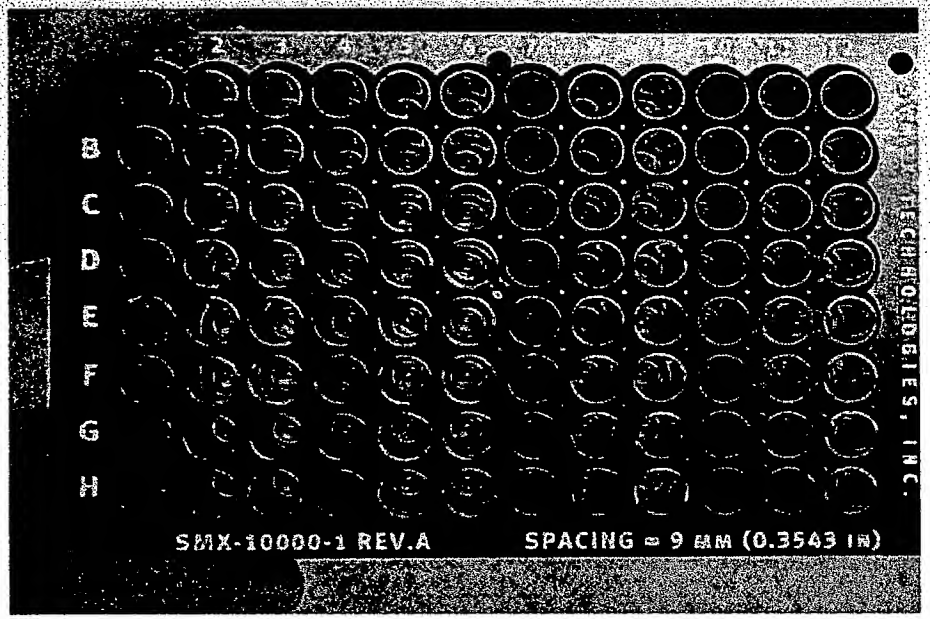


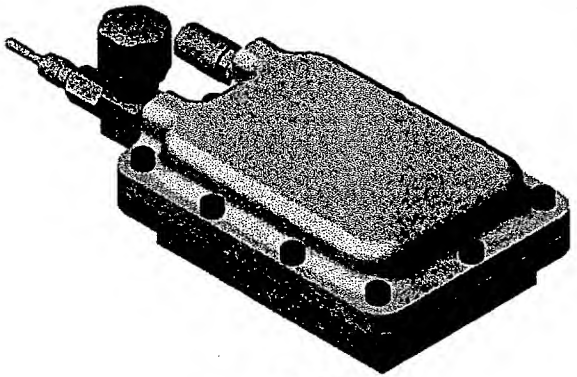
Primary Screen

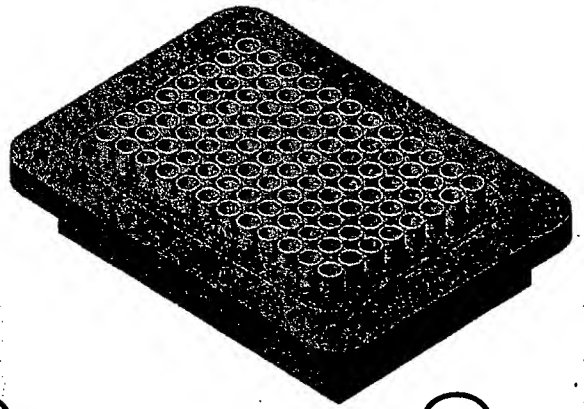
- **Activity**
- **Molecular Weight**

Rapid Primary Screen Using Post Reaction Gravimetric Analysis

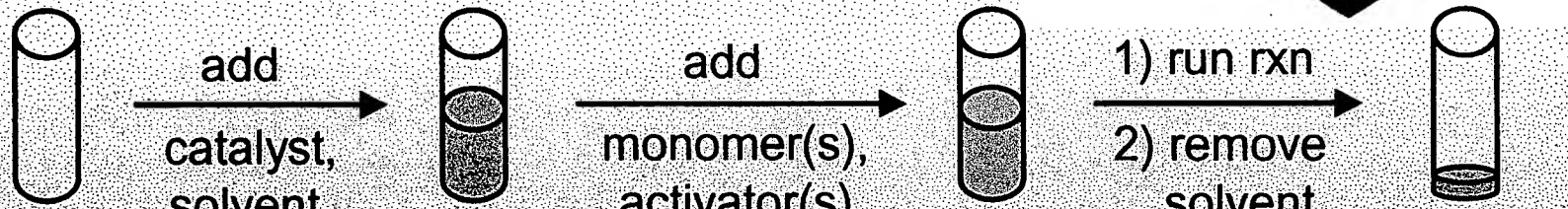
Symyx®



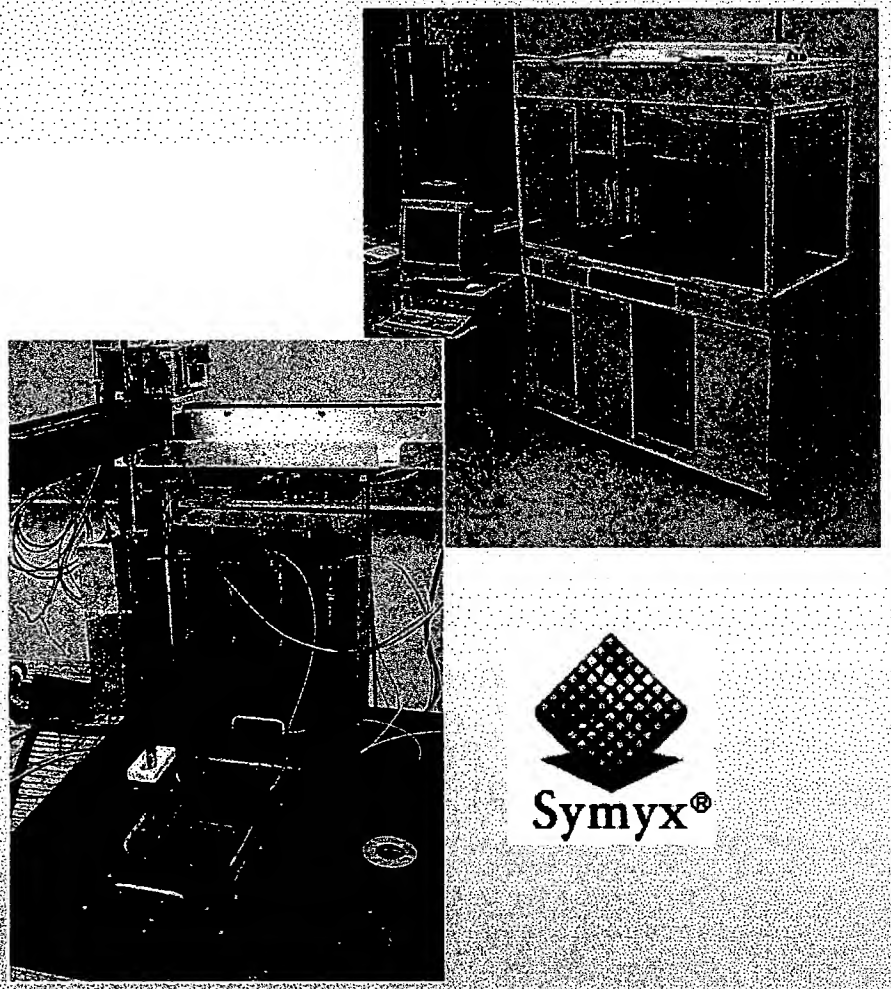




All Procedures Employ Robotic Liquid Handling



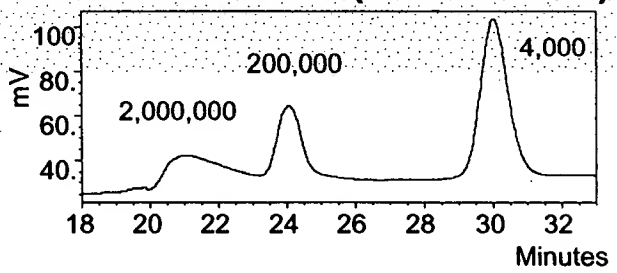
High-Throughput Molecular Weight Measurements
Symyx Rapid GPC™



Symyx®

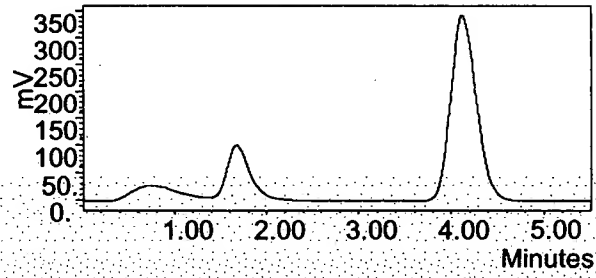
Conventional:
40 min/sample

Conventional (PL-GPC210)



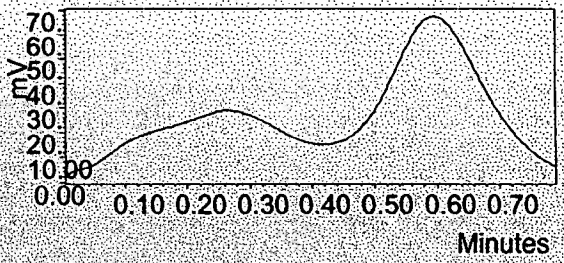
6 Minutes

High Resolution



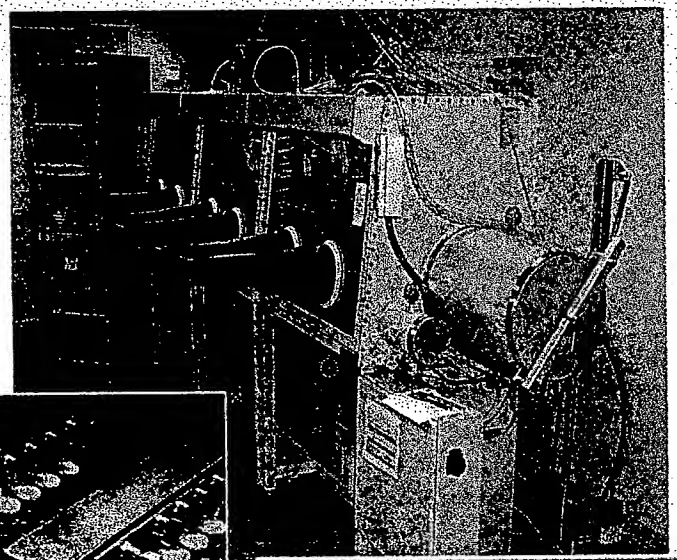
90 Seconds

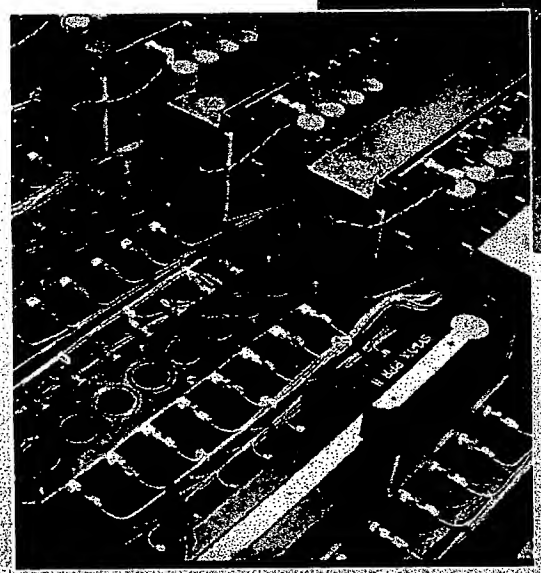
High Throughput

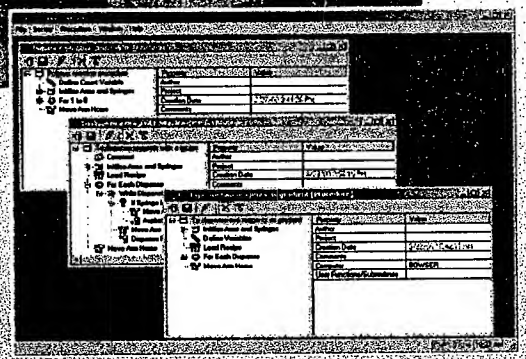


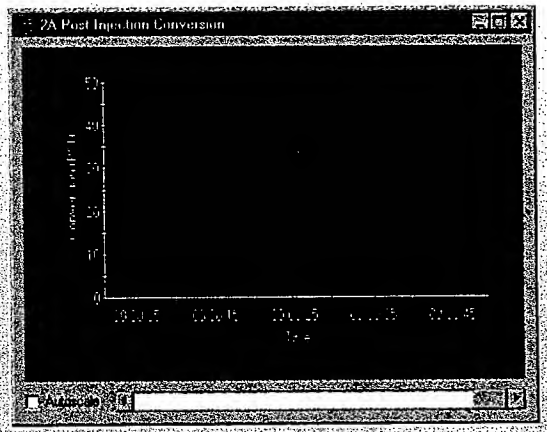
Secondary Screening Tools
Symyx Parallel Polymerization Reactor (PPR®)

Symyx®









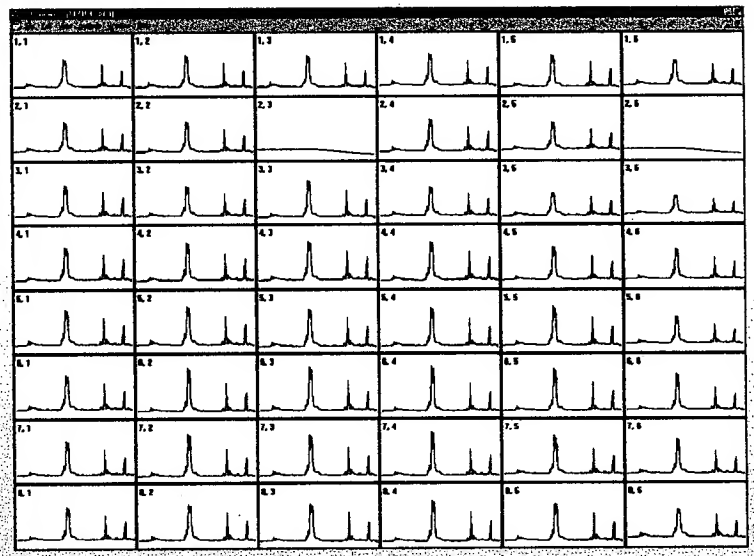
- 48 reactions per run
- 6 mL reaction volume
- Reagents injected robotically at T and P
- Real-time monitoring
  - T, P and gas uptake in cell

Secondary Screening Analysis: FT-IR

Symyx®

IR spectra of polymers allows rapid analysis of:

- co-monomer composition
- tacticity

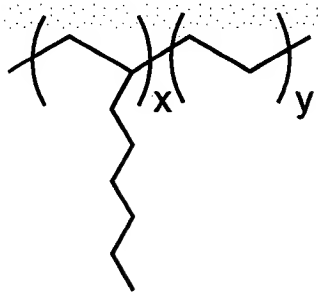


Automated Reflection FT-IR Analysis of Polymer Films

A Case Study of High-Throughput Catalyst Discovery

Target: High Temperature Solution Phase LLDPE Catalyst

- Catalyst must operate at temperatures > 130 °C
- Requires high activity, high M_w, high 1-octene incorporation



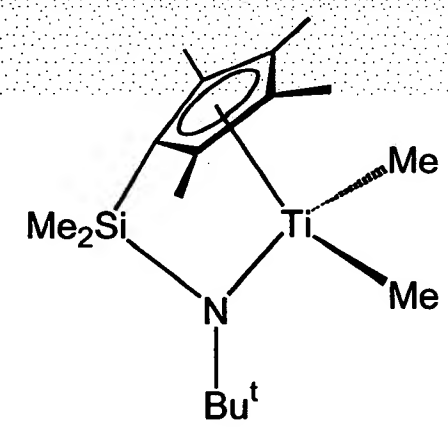
Primary Screen:
1-Octene Polymerization Activity

Hits and Information

1-Octene Polymerization Capability

Secondary Screen:
High Temperature Ethylene/ 1–Octene Screen

Adaption to Small Scale: Primary Screening Validation



1 ml Glass Vials

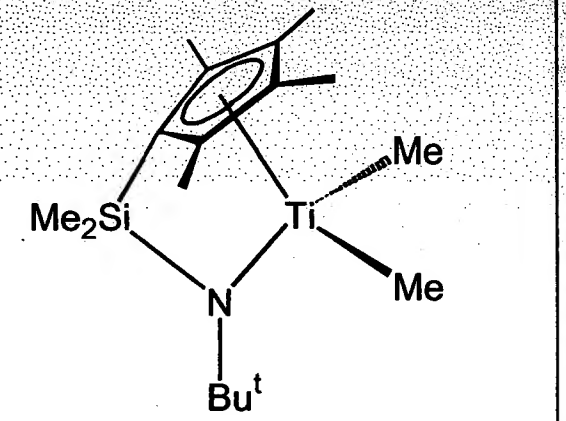
Monomer: 120 µl 1-Octene

Total Volume: 220 µl (toluene)

[8 x 12] Array

3 Catalyst Concentrations
4 Activation Methods
8 Replicates of Each Condition
Use robots to dispense reagents and to analyze products for speed, accuracy

Adaption to Small Scale: Primary Screening Validation



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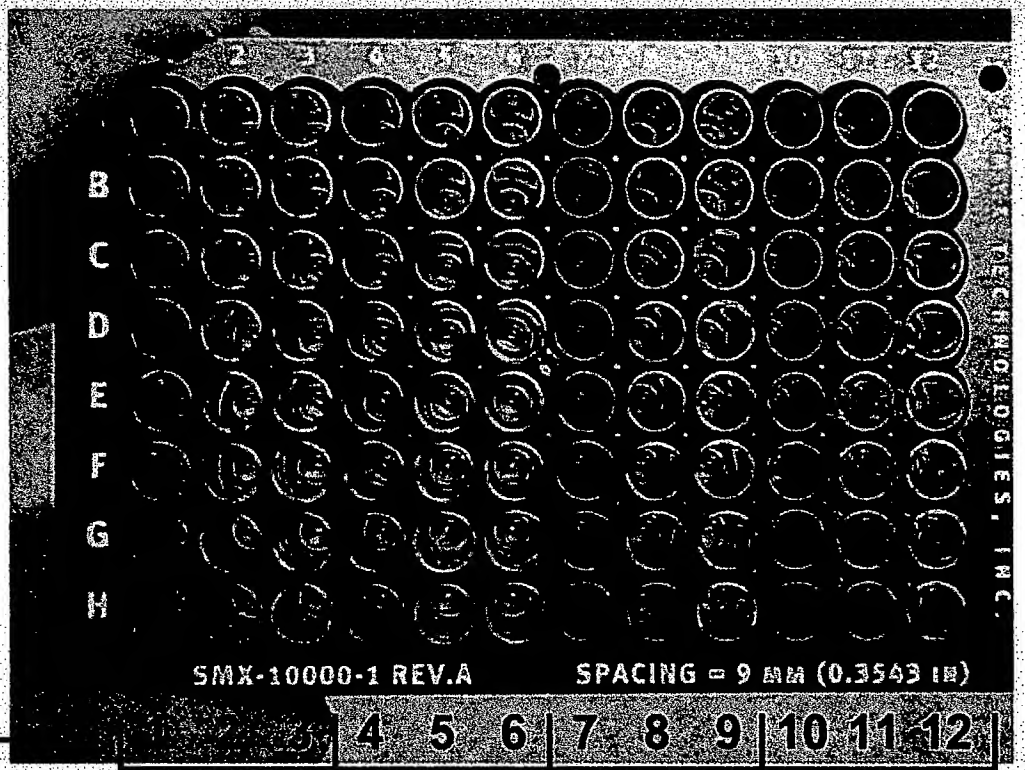


8 Replicates

Column No.	1	2	3	4	5	6	7	8	9	10	11	12
4 Activation Zones	None (Control)			200 eq. MAO			$[Me_2PhNH]^+$ $[B(C_6F_5)_4]^-$			$[Me_2PhNH]^+$ $[B(C_6F_5)_4]^-$ + 5 eq. Bu^i_3Al		
3 Catalyst Concentrations (mM)	1.8	0.18	.018	1.8	0.18	.018	1.8	0.18	.018	1.8	0.18	.018

Adaption to Small Scale: Primary Screening Validation Procedure

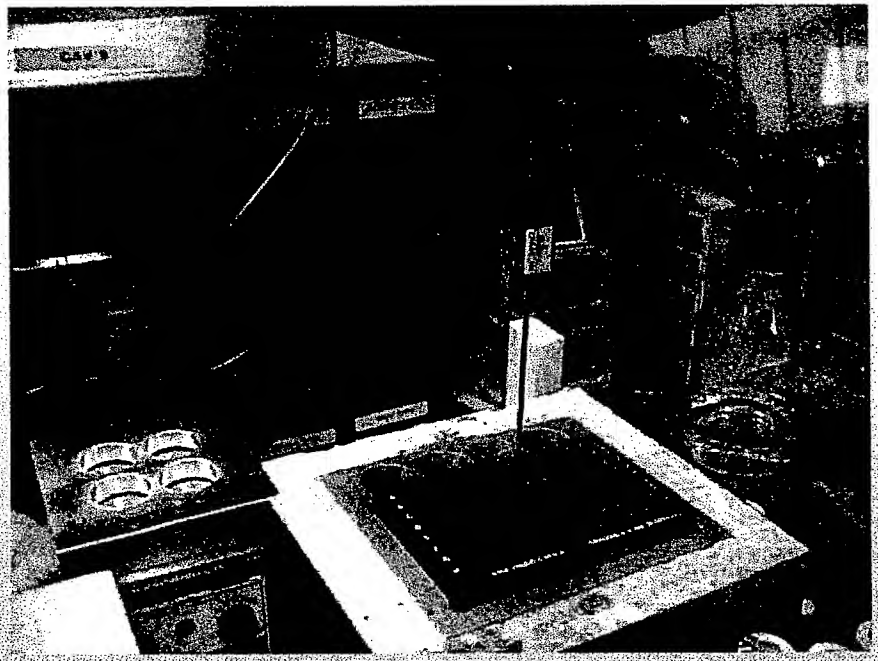
Symyx®

1. Add 120 µL 1-Octene.
2. Add Bu^i_3Al to columns 10, 11, 12.
3. Add $[(\eta^5\text{-}C_5Me_4)SiMe_2(\eta^1\text{-}NBu^t)]TiMe_2$.
4. Add Activators.

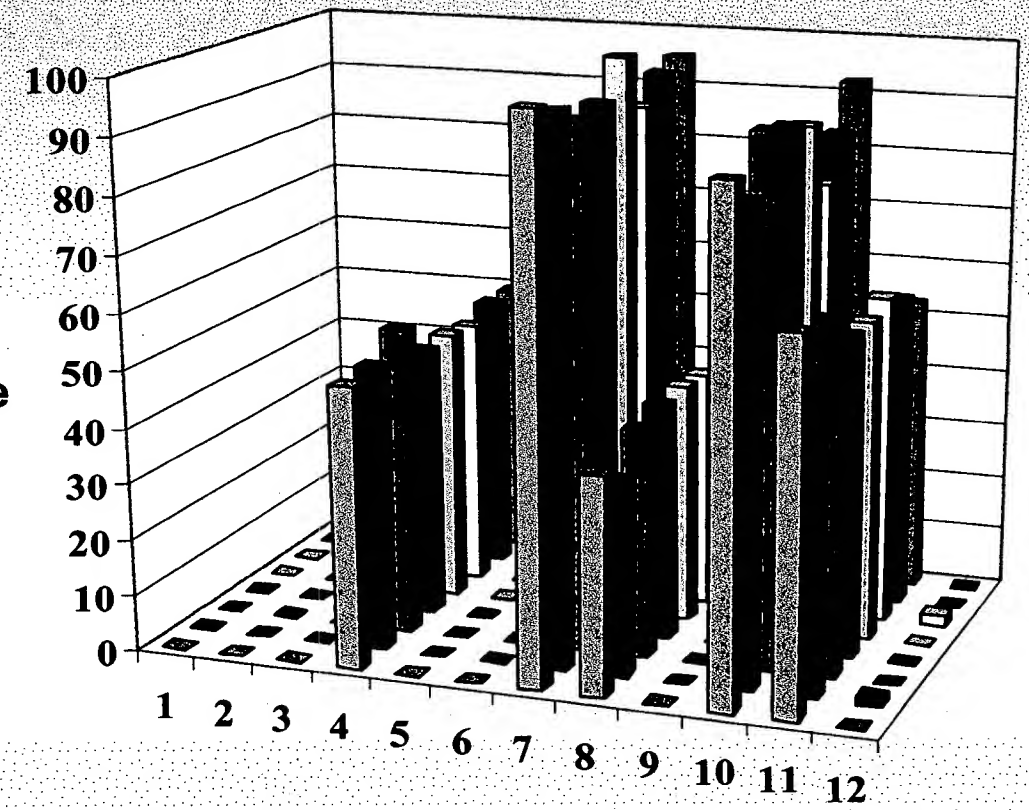
→

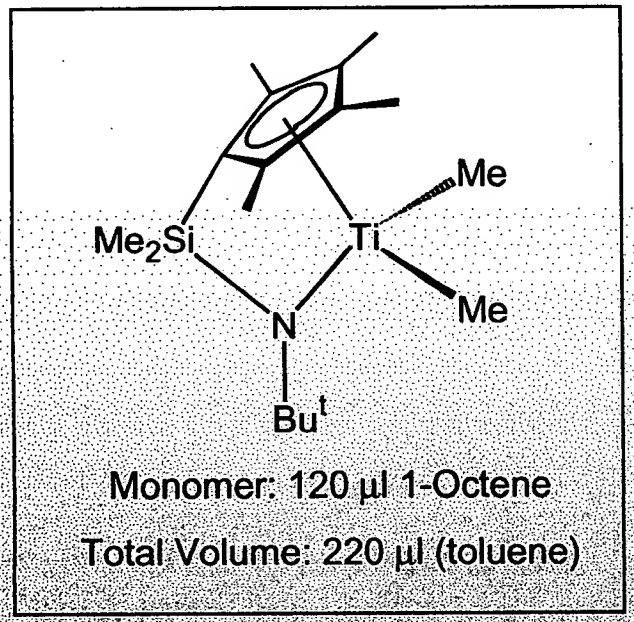
1. Run Polymerization
2. Quench, Filter
3. Automated Dilution
4. Rapid GPC™
5. Obtain M_w,Conversion

All Procedures Employ Robotic Liquid Handling

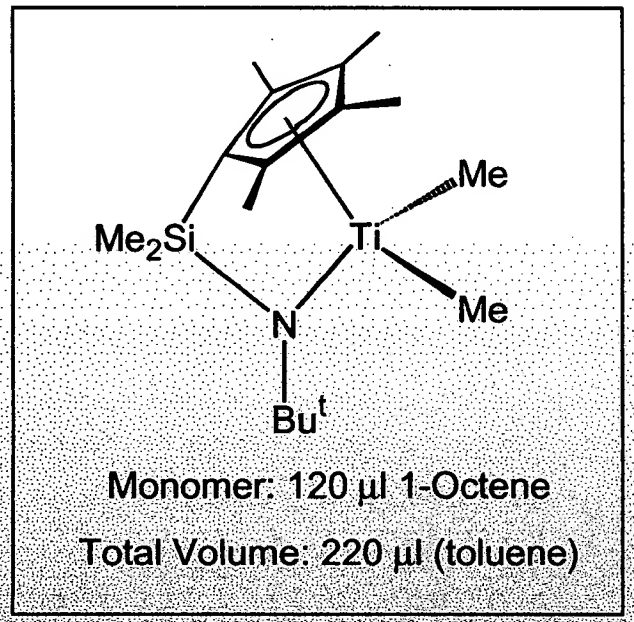


Adaption to Small Scale: Primary Screening Catalyst Activity Validation



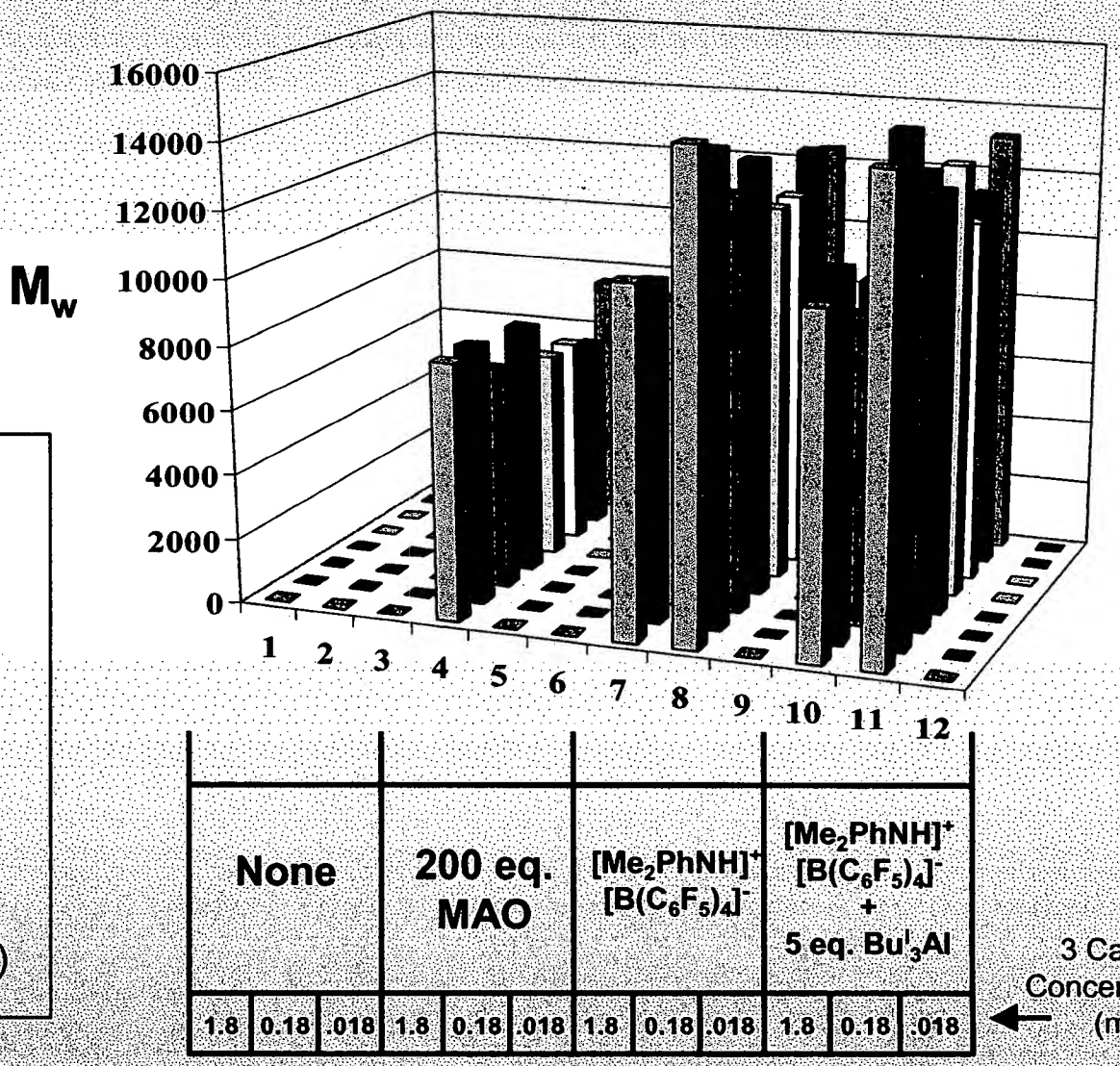


Adaption to Small Scale: Primary Screening Mw Validation



Monomer: 120 µl 1-Octene

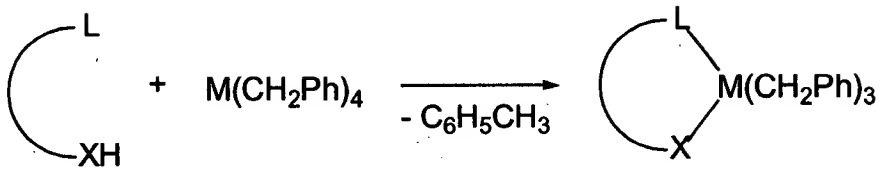
Total Volume: 220 µl (toluene)



Catalyst Discovery Screening

- Adaption of the Chemistry to Smaller Scale
- Large Number of Ligands with Suitable Diversity
- Efficient Methods of Attaching Ligands to Metals
- Suitable Rapid Screening Technique

The Use of Acidic ligands with $M(CH_2Ph)_4$ (M = Zr, Hf) *and* Multiple Activation Conditions



[3 x 8] Set of Charged Ligands

$M(CH_2Ph)_4$ (M = Zr, Hf)

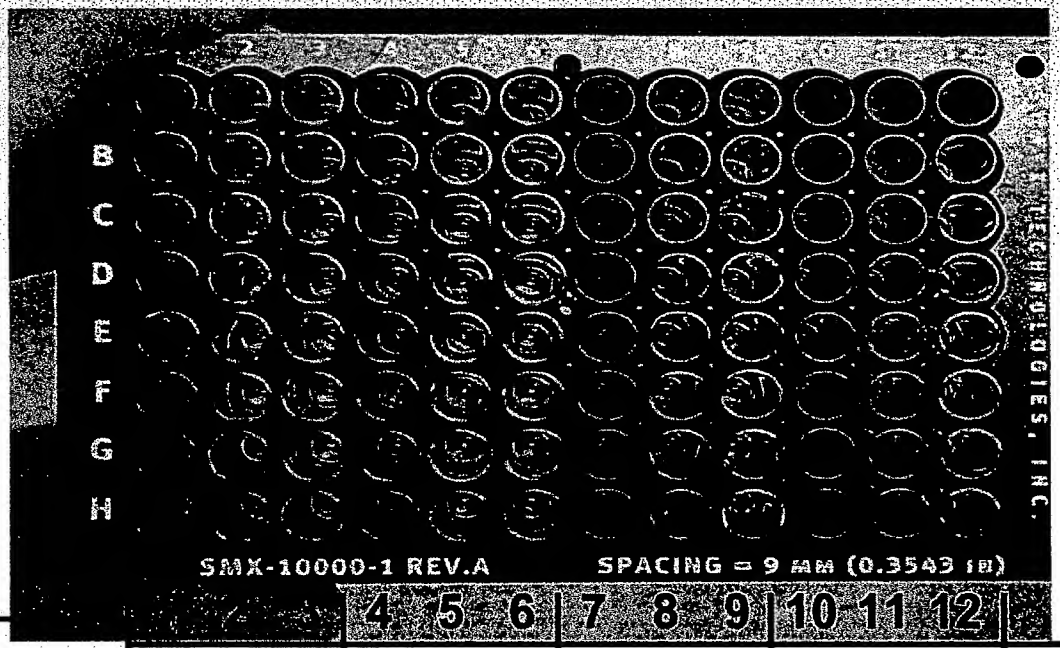
1 Hour, Toluene

Ligand/$M(CH_2Ph)_4$ Mixtures

Multiple Activation Conditions

Catalyst Discovery Screening - Plate Design

Discovery Plate Design
Eight Activation Conditions for Each Ligand/$M(CH_2Ph)_4$ Combination
- 2 plates of 4 conditions



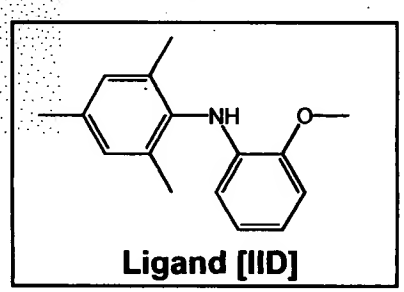
Column No. 4 5 6 | 7 8 9 | 10 11 12

Activation Zones →	$[Ph_3C]^+ [B(C_6F_5)_4]^-$ + 5 eq. Et_3Al	$[Ph_3C]^+ [B(C_6F_5)_4]^-$ + 5 eq. Bu^i_3Al	$[Me_2PhNH]^+ [B(C_6F_5)_4]^-$ + 5 eq. Et_3Al	$[Me_2PhNH]^+ [B(C_6F_5)_4]^-$ + 5 eq. Bu^i_3Al	1 ↓ **Row No.** 8
Ligand/$M(CH_2Ph)_4$ Concentration (mM) →	1.6	1.6	1.6	1.6	

4 Zones each containing [3 x 8] Ligand Set

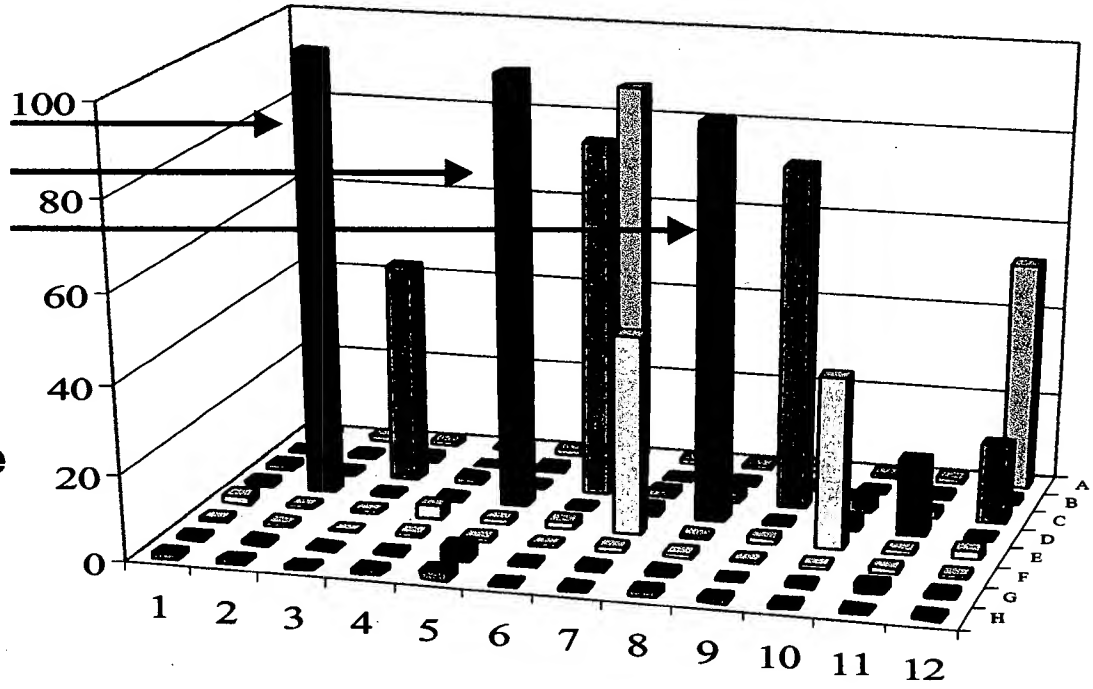
Catalyst Discovery Screening - Activity Results

% Conversion Data
$Hf(CH_2Ph)_4$



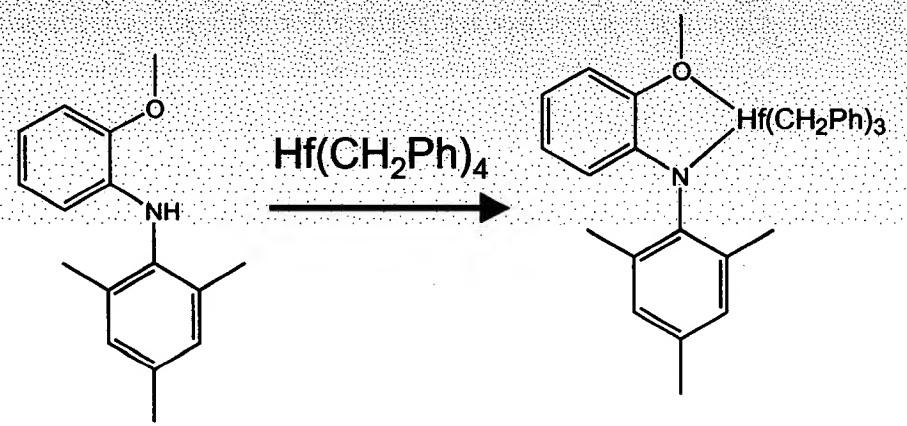
Ligand [IID]

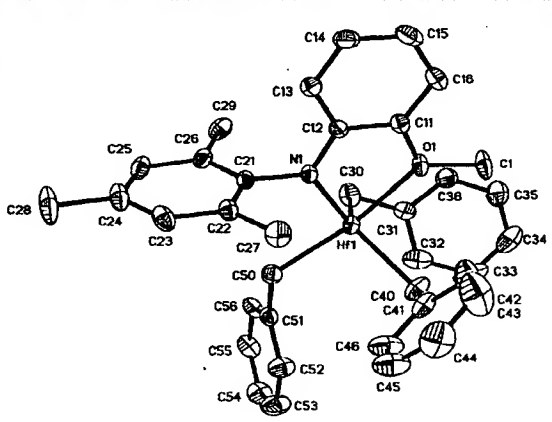
% Conversion to Poly-1-Octene

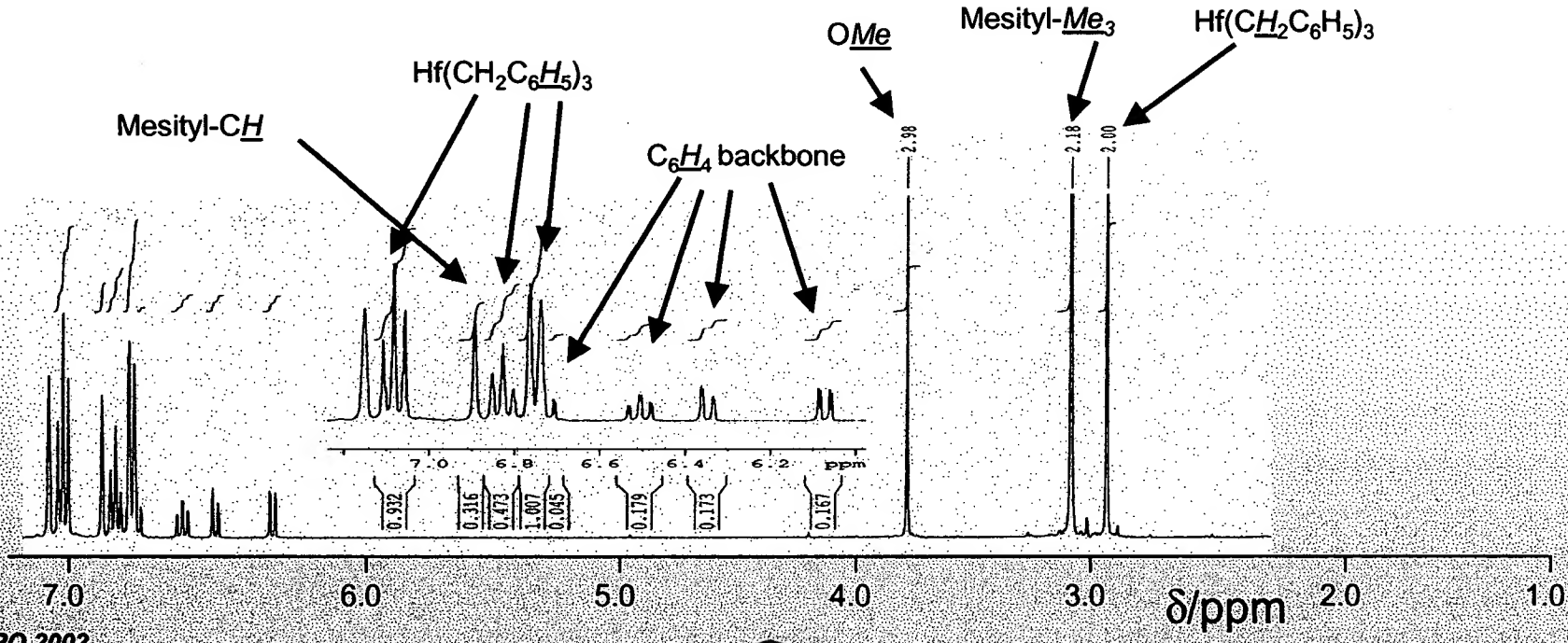


	$[Me_2PhNH]^+ [B(C_6F_5)_4]^-$ + 5 eq. Et_3Al	$[Me_2PhNH]^+ [B(C_6F_5)_4]^-$ + 5 eq. Bu^i_3Al	$[Ph_3C]^+ [B(C_6F_5)_4]^-$ + 5 eq. Et_3Al	$[Ph_3C]^+ [B(C_6F_5)_4]^-$ + 5 eq. Bu^i_3Al
Ligand/$Hf(CH_2Ph)_4$ Concentration (mM) →	1.6	1.6	1.6	1.6

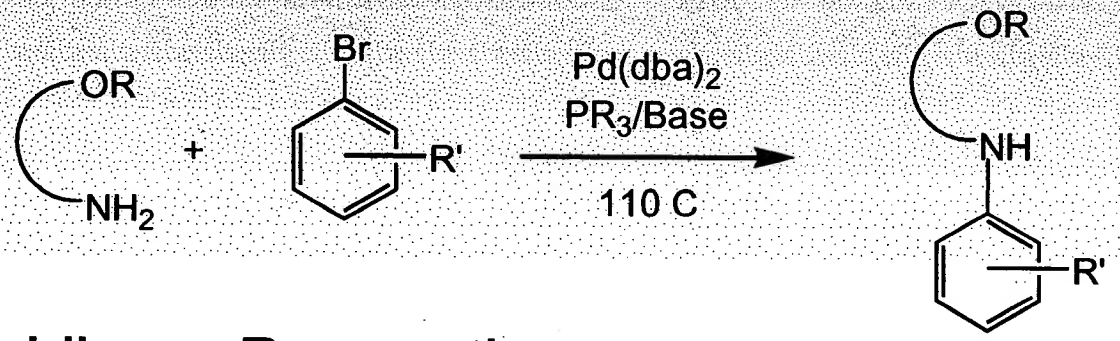
After Hit Identification, Conventional Chemistry Identifies Structure of Active Catalyst





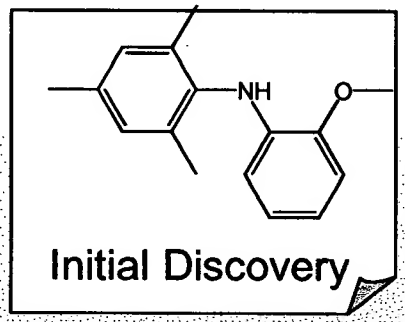


Focus Library of Structural Variation Around Identified Hit

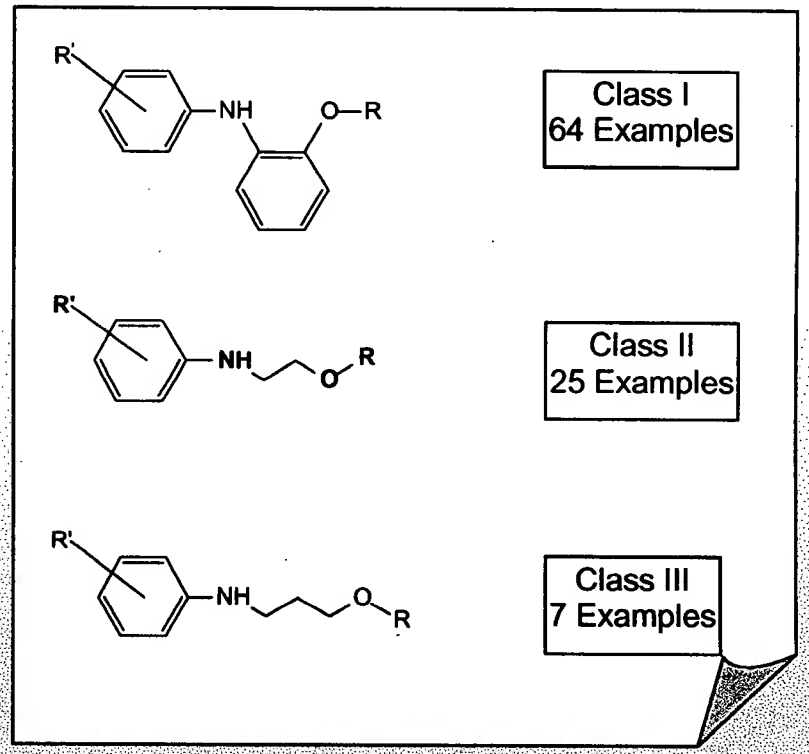


Focus Library Preparation

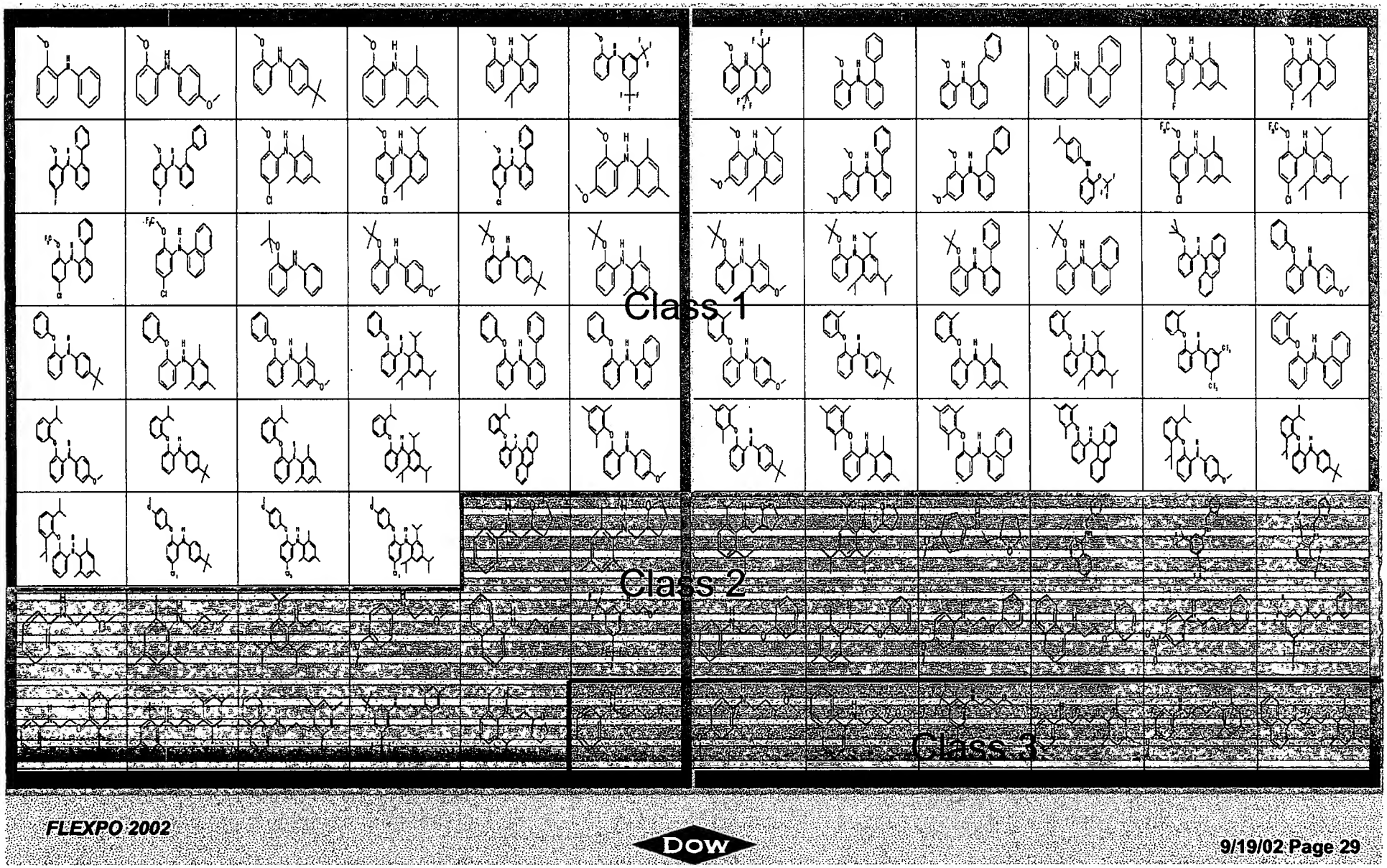
- 96 Structural Variations



Robotic synthesizers used to produce library



Focus Library for Amine Ether Hit



Secondary Screening

96 High Temperature Ethylene-Octene Copolymerizations

Reactor Conditions
130 °C, 100 psi Ethylene
6.1 mL Total (Toluene)
0.25 mL 1-Octene
2 μmol Bu^i_3Al
1 μmol $Hf(CH_2C_6H_5)_4$/Ligand

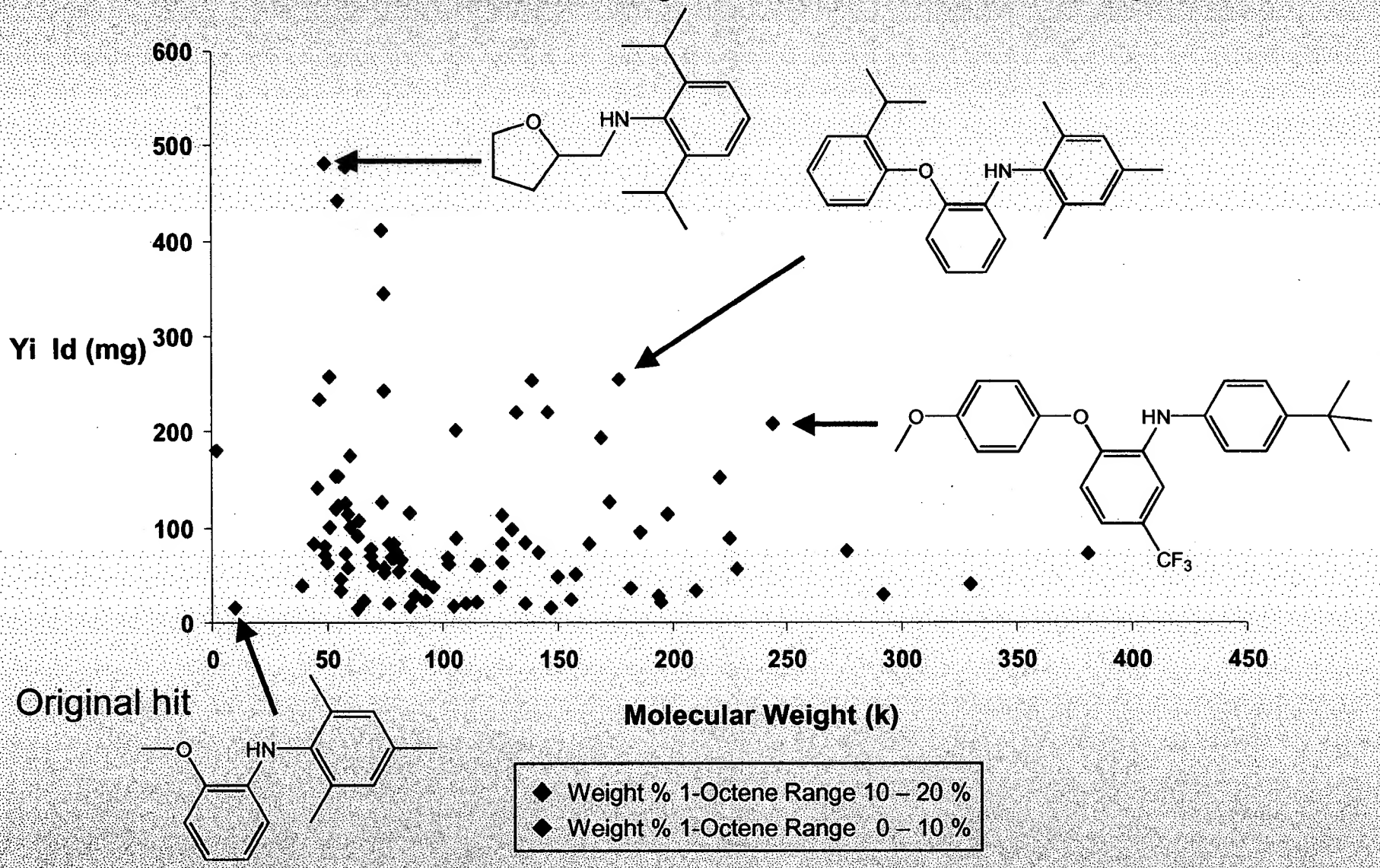
→ Target: 200-300 mg Copolymer

[8 x 12] Ligand Set → **$Hf(CH_2Ph)_4$** → **1 Hour, Toluene**

1) **Add Bu^i_3Al**
2) **Add $[Me_2PhNH][B(C_6F_5)_4]$**
3) **Inject Ligand/$Hf(CH_2Ph)_4$**
4) **Monitor Run for 30 Minutes**

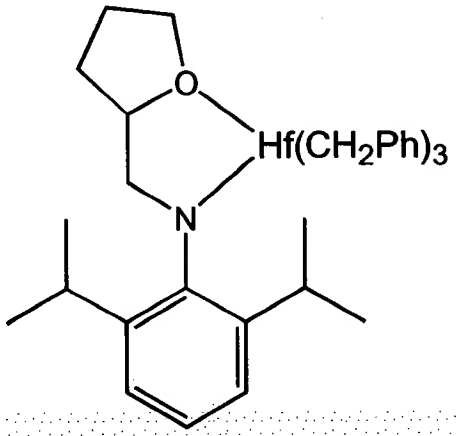
→ Obtain yield, molecular weight, MWD, wt.% 1-octene

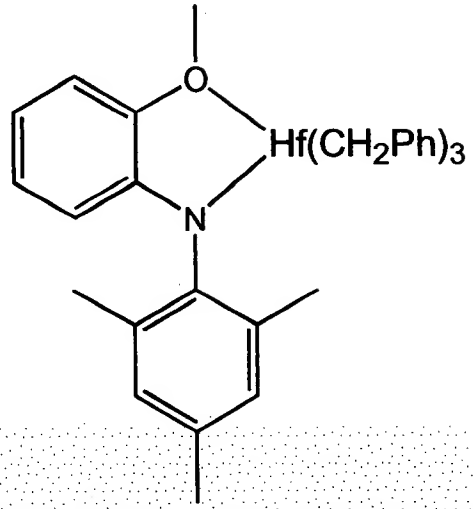
Focus Library Identifies Large Structure / Activity Effects in this Family, Improved Catalysts



1 Gallon Industrial Ethylene 1-Octene Autoclave Results Using Isolated Catalysts Validate Screening Results

Performed in Solution Phase at 130 °C





Activity (g poly/mmol Hf)	13,760	7,560
M_w	181 k	97 k
M_w/M_n	2.8	3.0
Density	0.917	0.910

Conclusions

Effective high-throughput combinatorial methods have been developed for organometallic polyolefin catalyst systems

Months or years of conventional catalyst research can be accomplished in days or weeks

Small-scale 1-octene polymerization screens were validated using a commercial catalyst

New hafnium post-metallocene catalyst family was discovered

Focus library of 96 structural variations was rapidly investigated

- significant enhancements observed
- wide variation in structure / property response

Optimized structures scaled up to commercial-scale process reactors